Private Crop Insurers and the Reinsurance Fund Allocation Decision

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Abstract

This research investigates the strategic behavior of private crop insurance firms reinsured by the USDA through the Standard Reinsurance Agreement. This arrangement allows the private firm to strategically allocate individual policies into different risk sharing arrangements. Thus, firm earnings are conditioned upon accurately forecasting policy loss experience. Our analysis begins with models investigating the characteristics explaining the placement of policies into the assigned risk fund. Then a simulation model of the SRA is used to compare the post-SRA returns of actual firm allocations to two alternative allocation strategies based on aggregate models and a policy-level econometric forecasting model.

Keywords: Insurance, Out-of-sample forecasting, Risk

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A unique aspect of the Federal crop insurance program since passage of the Federal Crop Insurance Act of 1980 has been the role of private insurance companies in program delivery and risk sharing (Glauber and Collins). Unlike other Federal insurance programs (*e.g.*, flood insurance), private insurance companies not only sell and service crop insurance policies but also annually share with the Federal government underwriting risks on over $45 billion of liability.

Because of the wide disparity in underwriting profits across regions and crops (Vedenov *et al*.), a problem facing the Federal crop insurance program has been how to encourage companies to deliver insurance policies in areas where expected gross underwriting profits are negative or potential underwriting exposure is high. To encourage the provision of Federal crop insurance to all eligible producers, the government shares risks with companies through the Standard Reinsurance Agreement (SRA) (USDA-RMA 1998, 2005). Under the SRA, if a company elects to write crop insurance policies in a state it must offer coverage to any farmer in that state. In addition, it must accept the rates and underwriting provisions set by the Federal Crop Insurance Corporation (FCIC). In exchange, the company is allowed to place potentially unprofitable policies in an Assigned Risk Fund where the company's exposure is minimal and to place potentially more profitable business in other funds that allow greater gain and loss sharing.

While much has been written on the Federal crop insurance program (see reviews by Goodwin and Smith, Coble and Knight, and Glauber), little research has appeared on the SRA. Notable exceptions include simulations of the SRA by Miranda and Glauber, Mason *et al.*, and Vedenov *et al*. These works have developed large-scale stochastic simulations to investigate potential changes in the structure of the SRA given an assumed fund allocation of the firm. In addition, Ker and McGowan modeled the potential for companies to use El Nino/La Nina

information to earn economic rents from the SRA reinsuring an area yield design. More recently, Ker and Ergün made an important step toward understanding actual insurance firm allocations and through out-of-sample testing found evidence that these firms do have significant private information. However, as Ker and Ergün note, their analysis was constrained by data aggregated across policies and across individual companies that did not allow for analysis of individual company behavior or attributes of individual policies.

In contrast, we examine policy-level allocation decisions made by individual crop insurance companies, analyzing firm-level reinsurance fund allocations made over 1998-2003. Using a logit model, we examine the characteristics of over 2 million individual crop insurance policies to identify the factors influencing allocation of policies to the Assigned Risk Fund and how these factors differ across companies. We then examine the allocation decisions of crop insurance firms and compare actual post-SRA gains to those of an allocation system based on an econometric model and a simpler county-level allocation system. The results show that firms are not equally effective in allocating policies to the Assigned Risk Fund. Although, in aggregate, firms are more effective in their actual allocations of policies than they would be if the simple county-level decision rule were used, allocations based on an out-of-sample econometric model forecasts generally result in greater underwriting gains than actual allocations.

Conceptual Framework

Under terms of the SRA, companies retain risks, or alternatively cede risks to FCIC, by designating individual crop insurance policies to reinsurance funds.[1] Different parameters of each of the funds allow a company to retain or cede different proportions of premium and associated liability (proportional reinsurance) and to share with FCIC different amounts of the eventual underwriting gains or losses on retained premium and liability (non-proportional

reinsurance). The levels of retention and of potential gains and losses to a company are highest on policies placed in Commercial Funds (three funds, each for a different type of insurance coverage) and lowest on policies placed in the Assigned Risk Fund. Intermediate levels of retention and gain and loss sharing are available in Developmental Funds. In the Assigned Risk Fund, 80 percent of the premium and associated liability is ceded to FCIC; the company retains 20 percent. Under the Developmental Fund, companies must retain at least 35 percent (and may retain up to 100 percent) of the premium and associated liability; under the Commercial Fund, companies must retain a minimum of 50 percent (and may retain up to 100 percent) of the premium and associated liability.

Of the liability retained by the company, FCIC pays increasing shares of the indemnities, depending on the company's state-level loss ratio in the fund, with FCIC paying the entire loss as the loss ratio (indemnities divided by total premium) exceeds 5.0. Shares of gains and losses to the private insurance companies differ markedly by fund (table 1). For example, the maximum possible underwriting loss on Assigned Risk policies is 11 percent of retained premium. The company's potential for underwriting gains on policies placed in the Assigned Risk Fund, however, is also small: maximum of 7.6 percent of retained premium. By contrast, companies can gain as much as 48.9 percent of retained premium for policies in the Commercial Fund. However, the downside risks are larger as well. The maximum possible underwriting loss on revenue policies placed in the Commercial Fund, for example, is 107.6 percent of retained premium.

Under the terms of the SRA, companies designate policies to the reinsurance funds up to 30 days from the sales closing date. In general this puts the allocation deadline slightly before planting. Insurance companies may use whatever information available at that time to decide

how much risk on which policies to retain or to cede. While limited information is available regarding prospective growing conditions, companies have access to a great deal of information regarding the insurance policy, including past experience.

The fund designation decision can be characterized in terms of the information sets used by FCIC and the company to determine the actuarial soundness of an insurance policy, that is, the relationship between total premium (producer paid premium plus premium subsidy), Π, and the expected indemnity E(I).

The FCIC uses an insurance premium rating system that is largely based on historical loss experience in a county for a particular crop and adjusted to policy specific characteristics. The FCIC, the government, G, assumes the expected indemnity is equal to premium resulting from these rate factors. Premiums are conditioned on crop price, P_g, coverage level, C_i, actual production history or APH yield, $\overline{Y}_i$, number of acres insured, A_i, and premium rate, R. The premium rate, in turn, depends on the insurance type (one of several revenue and yield insurance plans), T, the crop insured, K_i, the Actual Production History (APH) yield, the base county yield, $\widetilde{Y}_i$, the number of actual yields in the APH, N_i, unit selection (whether a policy's acreage is sub-divided into optional units), U_i, and the specific crop type and practice, P_i. The expected indemnity for the Government is summarized as follows:

$$(1) \qquad E(\mathrm{I} \mid G) = \Pi\left(P_g, C_i, \overline{Y}_i, A_i, R(T_i, K_i, C_i, \widetilde{Y}_i, N_i, U_i, P_i)\right)$$

The insurance firm is concerned with the net return of the policy $NR_i = (\Pi - E(I))$, which is driven by the perceived accuracy of the rating factors and other information about the policy. In particular, the insurance firm can utilize information from past participation, underwriting experience and early season growing conditions to adjust expectations of the net returns. Thus, we write the insurance firm's expectation of net return $E(NR|F)$ as a function of the policy

characteristics from equation 1 and add the firm's knowledge of historical loss ratios for the policy relative to peers, FI_i, the policy's continuous participation in the insurance program, FC_i, and year-specific early season growing conditions, FY_i.

$$(2) \qquad E(NR \mid F) = NR\left(P_g, C_i, \overline{Y}_i, A_i, R(T_i, K_i, C_i, \widetilde{Y}_i, N_i, U_i, P_i), FI_i, FC_i, FY_i\right)$$

Having defined the firm's expectation of the net return to the insurance policy, the policy allocation decision may be written as follows:

$$(3) \qquad \underset{\delta_i}{MaxL} = EU\left\{\sum_{i=1}^{N} \Gamma(\delta_i) NR(\bullet \mid F)\right\} \quad \text{s.t.} \quad \sum_{i=1}^{N} \delta_i \Pi(\bullet \mid G) < S$$

where δ is an indicator variable that represents the insurance firm's choice of which reinsurance fund to allocate the i^{th} policy.[2] The variable Γ is a function of δ, and represents the proportional share of premiums and indemnities retained by the crop insurance firm given the allocation of a policy to the i^{th} fund.

We couch the firm's decision in an expected utility framework where the private crop insurance firm is potentially risk averse and desires the risk reduction of the SRA. Thus, the risk context of the firm would also affect the decision to allocate policies to the Assigned Risk Fund. We characterize the risk context of the firm's crop insurance business by considering its effective premium rate, EPR_F, geographic concentration, CR_F, number of policies sold within a state, PC_F, as well as constraints on the amount of risk can be ceded under terms of the SRA, S.

In summary, we hypothesize that the insurance company's fund allocation decisions are affected by the company's portfolio and risk position along with the characteristics of the individual policies. This is shown in Equation 4.

$$(4) \qquad \delta_i = f\left[EPR_F, CR_F, PC_F, \text{S}, NR\left(P_g, C_i, \overline{Y}_i, A_i, R(T_i, K_i, C_i, \widetilde{Y}_i, N_i, U_i, P_i, FI_i, FC_i, FY_i)\right)\right]$$

Logit Model

A logit model consistent with equation 4 was specified to predict the allocation of crop insurance policies to the Assigned Risk Fund. We used producer policy-level records obtained from the U.S. Department of Agriculture's Risk Management Agency (RMA), the agency which administers the crop insurance program. These data report characteristics of policies insured between 1994 and 2003, and include the reinsurance fund designation for the policy for the years 1998 through 2003. The underlying RMA data are at the unit, or sub-policy, level. They contain characteristics of the crop types and practices used on the farm, the unit breakout within the policy, the yield histories, and actual loss experience on each unit. The data were aggregated by policy number and crop from the unit to the policy level, the level at which the Assigned Risk designation is made.[3] Data were weighted by the amount of liability in each unit.

Once the data for a particular year were aggregated to the policy level, then a search, by the tax identification number of the policy, was conducted across the four prior years to find whether the policy was in the crop insurance program in those years. The record for the policy was then used to calculate a historical loss ratio for the policy, which was attached to the year in which the policy was insured. Data were available from all states for the four top crops in the U.S. crop insurance program: corn, soybeans, wheat, and cotton.

Specific descriptions of variables used in the model are reported in table 2. Variables that represent the risk context of the insurance company's book of crop insurance business are listed first. The effective premium rate is the average premium rate of policies written by that company in a particular state and year and is calculated by taking the sum of all premiums written by the company within the state and year and dividing by the total associated liability. The effective premium rate is a measure of the overall riskiness of the company's business in the

state and year, and might influence its decision to designated individual policies to the Assigned Risk Fund.

The concentration ratio indicates the company's diversification of its portfolio across states in a particular year. The ratio, which is similar to the Herfindahl-Hirschman index used to measure market concentration, is the summation of the squared shares of total premium for a company's crop insurance business in each of the states. The ratio takes the value of 1 if a company operates in only one state during a particular year.

The policy count variable measures the size of the company's business in a state and the number of decisions the company may make on whether to use the Assigned Risk Fund. This variable is included to test the hypothesis that firms use different decision rules for Assigned Risk in states where the firm's volume of business is small.

A company is limited by the SRA on the proportion of its crop insurance business that can be placed in Assigned Risk. The secession limits, which are negotiated by the companies and FCIC, are known prior to the fund designation decisions. They vary by state, ranging from 10 to 75 percent of a company's total premium in a state.[4]

The next section of table 2 lists variables that are characteristics of the particular insurance policies.[5] The effective premium rate of the policy is constructed by dividing the sum (over the units in the policy) of total premium by liability for the policy. The loss ratio index is the historical loss ratio for the policy during the previous four years relative to the loss ratio for policies in the same county during the same period. In other words, the loss ratio index measures the loss ratio for a particular producer relative to a peer group of producers producing the same crop in the same county. We hypothesize that the greater the loss ratio index, the more likely the policy would be placed in the Assigned Risk Fund. In conjunction with the loss ratio index is the

ten-year average loss ratio for the crop in the county that indicates the actuarial soundness of the county-crop combination.

The next variable used to characterize the policy is the number of actual yields contained in the ten-year yield history that is used to establish insurance coverage. Because of aggregation across units, this variable is the average number of actual yields in the ten-year yield histories for the units within the policy. For example, a policy might have, on average, four and a half years of actual yields in the yield history used to calculate the yield guarantee. In general, the greater the number of actual yields, the more confident an insurer might be of the yield history and less likely it would be to designate the policy to the Assigned Risk Fund.

The yield span is the average APH yield for the units within the policy divided by the county reference yield. For example, if the average APH yield on a particular farm was 150 bushels for corn and the county reference yield was 100 bushels, then the yield span would take a value of 1.5. In general, the yield span gives an indication of whether the mean yields for a particular farm are above or below those of a peer group. Under current rating practices, farms with lower yield spans receive an exponentially higher rate than charged when the APH yield is at the county reference yield (Skees and Reed).

Coverage level is the next variable listed. The crop insurance program allows producers to choose from coverage levels that range from 50 percent to 85 percent of the expected yield or revenue. Higher coverage levels suggest a greater level of risk to the insurer. It is plausible that there would be a greater degree of moral hazard when the deductible is reduced, as occurs with higher coverage levels. Here the hypothesis is that insurance firms would likely put in Assigned Risk Fund policies with coverage levels that the company may believe to be less actuarially sound.

The variable "net acres insured" is the number of acres covered by the policy, weighted by the ownership share of the policyholder. The weighting avoids double counting of acres when both tenant and landlord insure the same acres under separate policies. If the policy covers 100 acres and the policyholder has a 50 percent share of the crop then there are 50 net acres insured. The variable "years" is the number of consecutive years, since 1994, that the policy has been in effect. It is hypothesized that, all else equal, the insurance firm would be more likely to place policies with shorter actuarial experience in the Assigned Risk Fund.

Crop insurance policies are also characterized by the type of insurance coverage: APH yield insurance at the catastrophic (CAT)[6] or higher coverage levels or one of several types of revenue insurance. To test whether designation of an insurance policy to the Assigned Risk Fund depends on the type of insurance, we construct a set of indicator variables with a non-CAT yield insurance policy as the default case. The CAT indicator variable has a value of 1 if the policy is at the minimal coverage level. The Crop Revenue Coverage (CRC) variable indicates that the policy is a revenue insurance coverage that can increase if crop price increases. Revenue Assurance (RA), during the period analyzed, is a type of revenue insurance without potentially increasing coverage. Income Protection (IP) is revenue coverage similar to RA, except that the policy cannot be divided into separately insured optional units. Finally, we include dummy variables to distinguish the crop insured: corn, wheat, cotton, and soybeans, and to capture the year-specific events. Summary statistics for the variables in the logit model are listed in table 3.

The possibility that pre-season weather may influence the fund allocation decision was considered, but it is difficult to measure what information the firms have at the time the decision must be made. Weather information such as monthly rainfall and temperature and subsoil moisture levels are available, but previous empirical work suggests that their influence on crop

growth varies widely by crop and region and in many cases show poor correlation (Luo, Skees, and Marchant). Second, if poor pre-season weather occurs it is likely to translate into a prevented planting or replant claim against the insurance policy. Of the data in our analysis, 6.26 percent of the policies had a prevented planting or replant claim. Less than 20 percent of those claims were placed in the Assigned Risk Fund. We also looked at the incidence of policies migrating in or out of the Assigned Risk Fund. Over the period examined a policy stayed in the same category as the previous year 89 percent of the time. This suggests a limited ability to predict losses that occur very near the SRA assignment date as opposed to losses occurring several months later.[7]

Table 4 shows the results of the logit model, for all companies together, of whether a crop insurance policy was designated to the Assigned Risk Fund. Given the large sample size and the many degrees of freedom, every explanatory variable is significant at the 0.001 level**.** The model fit was also quite high with a 79.7 percent concordance—that is, given a pair of policies, one in Assigned Risk and one not in Assigned Risk, the model predicted there was a higher probability of being placed in Assigned Risk for the policy that was actually placed into Assigned Risk.

Results of the company characteristics show that the effective premium rate of a company's crop insurance business has a positive relationship with placement of a particular policy in the Assigned Risk Fund. The geographic concentration ratio also has a positive relationship with designation to the Assigned Risk Fund. However, as a company has more policies in a state, it is less likely to place a particular policy in the Assigned Risk Fund. The state-level cession limit on the percent of liability that can be placed in Assigned Risk Fund has a positive relationship with whether policies are designated to that fund. Because the companies and FCIC negotiate the SRA cession limits, there is an incentive for the companies to press for

higher limits for states where they expect to place greater shares of their business in the Assigned Risk Fund. Thus, it is not surprising that there is a positive statistical relationship between the limits and companies' allocation of policies to Assigned Risk.

The remaining variables in table 4 are for individual policy characteristics. The effective premium rate for a policy has a positive relationship with designation to the Assigned Risk Fund. In other words, policies that are deemed riskier based on the rates charged are also more likely to be designated to Assigned Risk. The loss ratio index, which compares the individual policy to peers in the same county, has a positive relationship with placement in the Assigned Risk Fund. This suggests that firms consider the historical experience of individual policies in choosing whether to designate them to Assigned Risk. As expected, the number of actual yields in the yield history has a negative relationship with whether the policy is in Assigned Risk. Similarly, the results show that the number of years of continuous participation since 1994 is negative and significant. The longer continuous experience with a policy the less likely it is to be in Assigned Risk.

The yield span variable has a positive relationship with designation to Assigned Risk. This indicates that where the average yield for a policy's APH is greater than the county reference yield, then it is more likely the policy will be placed in Assigned Risk. Given rate adjustments across APH yields within a county, this result suggests insurers perceive relatively low yielding farms are more profitable policies to retain because of the rating system. The number of acres (net acres) covered by a policy has a positive and statistically significant relationship with placement in the Assigned Risk Fund.

Coverage level, the percent of expected yield or revenue that is insured, is positively related with allocation to Assigned Risk. The higher the coverage level, the more likely it is that

policies will be placed in Assigned Risk. This suggests that crop insurance companies do not perceive coverage levels to be equally actuarially sound, which may stem from perceptions that policies with lower deductibles are more prone to moral hazard problems.

The policy dummy variables show that CAT policies were significantly less likely to be placed in the Assigned Risk Fund. CRC and the RA policies are more likely and IP policies are less likely, relative to APH yield insurance policies, to be placed in Assigned Risk. The crop dummy variables show that cotton and wheat policies are more likely and soybean policies are less likely than corn policies to be in Assigned Risk. The year dummy variables were all significant and indicate that, relative to 2003, policies in 1999 and 2000 were more likely to be placed in Assigned Risk while policies in 1998, 2001 and 2002 were less likely to be placed in Assigned Risk.

The logit model was also estimated separately for each company. Table 5 reports a summary of the 17 firm-level logit models of the same variables as the aggregate model. (The full results of the firm-level models are in Appendix Table 1). In the company models, most of the policy variables were strongly significant and consistent with the aggregate model.[8] Concordance measures were high as well.

For example, estimated coefficients for the effective policy premium rate, the loss ratio index, and the county loss ratio were largely positive and significant. These results are consistent with the strong marginal effects observed in the aggregate model. The number of actual yields is also consistent across firm level models. In 15 of the 17 firms, it has a negative and significant effect. In only one firm was there a positive effect. The yield span variable is positive and significant in the aggregate model and it remains positive and significant in ten of the 17 firm level models.

Of the remaining variables, there was less agreement in signs across firms. Most of the differences can be explained by the fact that many of the variables were related to the various regions in which the companies concentrate their business. For example, a number of companies concentrate their business in Midwestern states where few, if any, cotton policies are sold.

Effects of the Allocation Decisions on Underwriting Gains

Given evidence that the characteristics of the firm, characteristics of the SRA in a particular state, and characteristics of the individual policy, are explanatory variables predicting whether policies are placed in Assigned Risk, what are the economic implications of the allocation? In general, firms have been able to cede policies with underwriting losses to the government by placing them in the Assigned Risk Fund while they retain policies with underwriting gains. From 1992-2003, the loss ratio for policies placed in the Assigned Risk Fund exceeded the loss ratio for policies placed in Commercial Funds in all years but one (Glauber). For the policies in our study, the loss ratio for the years 2001-2003 for the policies that were placed in the Assigned Risk Fund exceeded the loss ratio for policies that were not placed in the Assigned Risk Fund. Policies with about $593 million in premiums were placed in Assigned Risk Fund; about $711 million in indemnities was paid on these policies, resulting in a loss ratio for the Assigned Risk policies of 1.20. In contrast, the loss ratio for non-Assigned Risk policies was 0.85 ($2.2 billion in indemnities divided by $2.6 billion in premium).

But how effective have the private crop insurance companies been in allocating policies? Said another way, was the actual allocation used the most efficient allocation for the crop insurance companies under the terms of the 1998 SRA? To analyze this, two alternative approaches to the insurance company's actual allocation were investigated. The first is a naïve rule that allocates policies based on the historical loss ratio for the county; the other uses a Tobit

model to predict the loss ratio for each individual policy. Under the naïve approach, the historical loss ratio for each of the counties within a state was calculated over the 1981-2000 period. Counties within the state were ranked from high to low based on their aggregate historical loss ratio. Policies were then placed into the Assigned Risk Fund on a county-by-county basis beginning with the county with highest loss ratio and continuing until the county loss ratio fell below 1.125 or the state Assigned Risk cession limit was reached.[9]

The second approach uses an econometric model to predict the loss ratio for each individual policy. In a similar manner as above, policies were ranked within a state from high to low based on their expected loss ratio. Policies were then placed into the Assigned Risk fund beginning with the policy with the highest expected loss ratio and continuing until the policy expected loss ratio fell below 1.125 or the state Assigned Risk cession limit was reached.

The model of predicted loss ratio uses the same insurance policy characteristic variables of that were used in logit model. A Tobit model was used to account for censoring of the loss ratio at zero. The firm characteristic variables of the logit model were not included because the firm's characteristics are not causal factors in forecasting a particular policy's loss ratio. The cession limit variable was retained because it is an exogenous context for the policy decision. As shown in table 6, all the variables in the Tobit model are strongly significant. The cession limit variable is positively related to the expected loss ratio suggesting higher cession limits are indicative of higher expected loss ratios in that state. The effective premium rate has a positive relationship with the expected loss ratio, and is indicative of whether the premium rate charged is a strong indicator of the observed loss ratio. There is a positive relationship between the loss ratio index and the observed loss ratio. In other words, the historical performance of a policy relative to peers producing the same crop in the same county assists in predicting the observed

loss ratio. However, county loss ratio has a negative effect. The number of actual yields used in the yield history has a negative relationship with the predicted loss ratio, suggesting that policies that have more years of actual yields are less likely to have a high loss ratio. This is not surprising given that with increased number of actual yields, the expected yield for the farm can be estimated more accurately and therefore reduce rate setting error.

The next variable, yield span, has a positive relationship with the observed loss ratio. Coverage level also has a positive relationship, suggesting that policies with a higher coverage level would be expected to have a higher loss ratio. This may be the result of decreasing deductibles and greater moral hazard at higher coverage levels. Net acres are shown to have a positive relationship with the observed loss ratio. In other words, larger farms, all else equal, tend to have slightly higher loss ratios. The number of years of continuous participation since 1994 has a positive effect, indicating that policies with more years of continuous participation have a higher loss ratio.

The next set of variables characterizes insurance design. CAT insurance is associated with a lower expected loss ratio. In other words, these policies tend to be more actuarially sound (over the period examined) than the higher levels of insurance. CRC and RA policies have a higher expected loss ratio than the default yield insurance plan, while IP is less likely to have a high loss ratio. Among the crops, the expected loss ratios for wheat, cotton, and soybeans all tend to be higher than that of the default corn category.

Comparison of Alternative Policy Assignment Strategies

Having estimated a naïve model and a more sophisticated policy-level model to be used to allocate policies to the Assigned Risk Fund, the implications of firm allocation decision can be examined. This is done by applying provisions of the SRA on the outcomes of the alternative

fund designation rules. We applied a simplified version of the 1998 SRA, the SRA that was in effect during the time period from which our data were drawn. We simplified the SRA by allowing policies to be placed in either the Assigned Risk Fund or in one of the three Commercial Funds. We also assumed, for simplification, that companies would retain 100 percent of the premium and associated liability on the Commercial Fund policies (and retain 20 percent of the premium and associated liability for policies in the Assigned Risk Fund, as specified in the SRA).[10]

Table 7 reports the aggregate the underwriting gains and losses under the alternative decision rules and under the actual allocation of the crop insurance firms. We examined the actual underwriting experience for the policies under all three allocation rules in and out-of-sample time period, 2001-2003. Under the actual allocation, companies placed $570.2 million out of a total $3,101.7 million (18.2 percent) in the Assigned Risk fund. Over the period, gross underwriting gains in the Commercial Fund were $213.4 million. Over the same period, policies in the Assigned Risk fund had gross underwriting losses of $120.9 million. Total gross underwriting gains for all funds were thus $213.4 million. However, under the 1998 SRA, net underwriting gains (*i.e.*, post-SRA) were $311.3 million, reflecting the ability of the companies to cede more unprofitable business to FCIC through the Assigned Risk Fund.

Under the naïve county-based model, companies would have placed a similar proportion of total premium in the Assigned Risk fund as under the actual allocation ($550.3 million, about 17.7 percent). However, net underwriting gains under the county-based model were only $290.9 million, about 6 percent less than under the actual allocation. This suggests that the current allocation used by companies is more discriminating than a model that allocates policies based on county-level performance.

Under the policy-level model, companies would have placed 26.5 percent of total premium in the Assigned Risk fund ($821.6 million). Aggregate net underwriting gains for all firms would have been $320.9 million, about 3 percent higher under the policy-level model than under the actual allocation and 10 percent higher than under the naïve allocation model. Because more premium is placed in the Assigned Risk fund (where less premium and associated liability is retained by the company), the rate of return—defined as net underwriting gain as a percent of retained premium—is over 13 percent, compared to about 11 percent under the actual and county-level allocations.

Although the policy-model improves underwriting of the companies in aggregate, its performance at the individual firm level varies (table 8). Of the 17 private companies, 14 placed a larger proportion of premium in Assigned Risk Fund under the policy-level allocation than under the actual or county-level allocation. Net underwriting gains as a percent of retained premium were higher under the policy-level allocation for 13 of the 17 companies. Generally, the policy-level allocation tended to produce the highest net underwriting gain of the three methods when the gross (*i.e.*, pre-SRA) loss ratio was high. For example, for those companies where the gross loss ratio was greater than 1.0, the policy-level allocation tended to producer the highest return. When the gross loss ratio was less than 1.0, the results were more mixed. This suggests that for firms operating primarily in states where the actuarial performance has been generally profitable (*e.g.*, Iowa, Minnesota, and Illinois) it may be less important to discriminate between policies. In these states, the "cost" of placing business in Assigned Risk—the loss of potential underwriting gains—offsets the benefits of protecting against the risk of underwriting loss. In states where the actuarial performance is poor, however, companies may be able to improve underwriting gains by carefully discriminating between policies.

Conclusions

With the rapid growth of the crop insurance program over the past 10 years, retained premiums by companies has growth dramatically from $466 million in 1992 to almost $2.6 billion in 2003 (Glauber). As companies have retained more risk, their exposure has increased proportionately. In 2003, for example, the maximum possible underwriting loss to companies was almost $2.4 billion (Glauber). With increased liability and risk exposure, companies must discriminate between crop policies between those that are profitable and those that are not.

Our analysis suggests that companies incorporate available information on policyholders in allocating crop policies to the Assigned Risk Fund. Variables such as a policy's previous actuarial experience relative to peers in the county were found to be significant suggesting that companies take into account information regarding the potential profitability of a policy in making the fund allocation decision.

In general, the current allocation strategy employed by companies outperforms more simplistic strategies that allocate policies based on aggregate measures such as county loss ratios. However, our analysis also suggests that some additional underwriting profits could be gained by a more careful estimation of a policy's expected loss ratio, particularly in those states where underwriting performance is generally poor. Here, net underwriting profits can be improved or net underwriting losses reduced by more carefully discriminating between profitable and unprofitable policies.

[1] This analysis is based on the 1998 Standard Reinsurance Agreement, which was in effect with minor modifications, from 1998 through 2004 (USDA-RMA 1998).

[2] In this analysis, we simplify the choice whether to designate a policy to the Assigned Risk Fund versus the other funds because the data in the early years of the study did not distinguish non-Assigned Risk policies between Commercial and Developmental Funds.

[3] Insurance indemnities are paid out at the unit (sub-policy) level, but the Assigned Risk designation is made on a policy-by-policy basis.

[4] The 1998 SRA required that a company retain an overall minimum of premium and associated liability: 35 percent, or 22.5 percent if more than 50 percent of its entire business is in Assigned Risk. In practice, actual retentions have not approached this constraint. We do not include it in our analysis.

[5] A producer may have more than one policy because a crop insurance policy is for a particular crop. If a producer has insurance on more than one crop, we treat the two crops as two policies with separate characteristics. In aggregating from the unit level to the policy level, the unit structure and the type practice variables became relatively uninformative in our preliminary analysis and were dropped.

[6] Catastrophic or CAT coverage is the lowest coverage level available: 50 percent of expected yield indemnified at 55 percent of expected price. The maximum coverage level, for a farm-based policy, is 85 percent of expected yield or revenue. We exclude county-based yield and revenue policies, which account for small shares of the crop insurance business, from our analysis.

[7] To the degree there is adverse selection because of early season weather, some of the variation may be explained by the inclusion of annual dummy variables.

[8] The company characteristic variables (effective premium rate for company, geographic concentration ratio, policy count, and cession limit) were the same for all policies for a given company for a given year. Any variation thus reflects changes in a company's mix of business from year to year.

[9] Because of the asymmetry of the SRA, marginal gains can be achieved on policies with an expected loss ratio greater than 1.0. A grid search for an optimal decision rule found that for both county and policy level models post-SRA gains were maximized by a 1.125 allocation rule.

[10] Again, this is due to a lack of allocation identifiers in a portion of the data.

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Table 1—Shares of Underwriting Gains and Losses to Insurance Companies under the 1998 Standard Reinsurance Agreement

Loss Ratio	Reinsurance Fund						
	Assigned Risk	Developmental			Commercial		
		CAT	Revenue	All Other	CAT	Revenue	All Other
	Percent of Loss/Gain						
Losses:							
1.0 – 1.6	5.0	25.0	30.0	25.0	50.0	57.0	50.0
1.6 – 2.2	4.0	20.0	22.5	20.0	40.0	43.0	40.0
2.2 – 5.0	2.0	11.0	11.0	11.0	17.0	17.0	17.0
> 5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gains:							
0.65 – 1.0	15.0	45.0	60.0	60.0	75.0	94.0	94.0
0.5 – 0.65	9.0	30.0	50.0	50.0	50.0	70.0	70.0
< 0.5	2.0	4.0	6.0	6.0	8.0	11.0	11.0

Table 2—Explanatory Variables in Logit Model of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Description
Company Characteristics/Risk Context:	
Effective Premium Rate-Company	Total premium divided by liability of policies written by company in a State in a year.
Geographic Concentration Ratio	Index of diversification of company's premium across States.
Policy Count	Number of crop insurance policies written by company in a State.
Cession Limit	Maximum proportion of premium and associated liability in a State permitted in the Assigned Risk Fund.
Policy Characteristics:	
Effective Premium Rate-Policy	Total premium divided by liability for the insurance policy.
Loss Ratio Index	Loss ratio (indemnities/total premium) for policy during the previous four years relative to the loss ratio of all policies in the county.
County Loss Ratio	Average loss ratio for the crop in the county over the previous ten years.
Number of Actual Yields	Average number of actual yields in the Actual Production History (APH) for units within the policy.
Yield Span	Average APH yield for units in the policy relative to the county reference yield.
Coverage Level	Percent of expected yield or revenue covered by policy.
Net Acres Insured	Acres insured under policy weighted by ownership share.
Years	Number of years of continuous crop insurance participation since 1994.
CAT Coverage	Indicator variable, equals one if policy is at the minimum, CAT coverage.
Insurance Plan*:	
Crop Revenue Coverage (CRC)	Indicator variable, equals one if policy is CRC insurance plan.
Revenue Assurance (RA)	Indicator variable, equals one if policy is RA insurance plan.
Income Protection (IP)	Indicator variable, equals one if policy is IP insurance plan.
Crop**:	
Soybeans	Indicator variable, equals one if policy is for soybeans.
Wheat	Indicator variable, equals one if policy is for wheat.
Cotton	Indicator variable, equals one if policy is for cotton.
Year***	Indicator variables for year of insurance coverage, 1998 – 2003.

* Default insurance plan is APH Yield. ** Default crop is corn. *** Default year is 2003.

Table 3—Summary Statistics of Variables in Logit Model of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Assigned Risk				Not Assigned Risk			
	Mean	Std. Dev.	Minimum	Maximum	Mean	Std. Dev.	Minimum	Maximum
Company Characteristics/Risk Context:								
Effective Premium Rate-Company	0.097	0.030	0.026	1.000	0.081	0.025	0.016	0.542
Geographic Concentration Ratio	0.143	0.173	0.055	1.000	0.134	0.174	0.055	1.000
Policy Count	4,157.1	3,640.3	1	24,419	6,195.5	5,491.6	1	24,419
Cession Limit	0.331	0.185	0.100	0.750	0.244	0.125	0.100	0.750
Policy Characteristics:								
Effective Premium Rate-Policy	0.124	0.079	0.005	0.999	0.078	0.052	0.001	0.994
Loss Ratio Index	1.254	2.434	0	428.29	0.748	2.106	0	668.572
County Loss Ratio	1.039	0.602	0	8.72	0.673	0.425	0	6.968
Number of Actual Yields	7.195	2.602	0	10	7.604	2.466	0	10
Yield Span	1.198	0.255	0.127	9.612	1.219	0.218	0.018	15.171
Coverage Level	69.067	7.398	50	85	66.341	8.986	50	85
Net Acres Insured	260.64	408.91	0.08	31,134.00	182.10	270.84	0.07	28,514.20
Years	6.027	1.528	4	9	5.942	1.530	4	9
CAT Coverage	0.027	0.161	0	1	0.099	0.299	0	1
Crop Revenue Coverage (CRC)	0.409	0.492	0	1	0.282	0.450	0	1
Revenue Assurance (RA)	0.146	0.353	0	1	0.116	0.320	0	1
Income Protection (IP)	0.003	0.058	0	1	0.011	0.104	0	1
Soybeans	0.256	0.437	0	1	0.389	0.488	0	1
Wheat	0.476	0.499	0	1	0.215	0.411	0	1
Cotton	0.012	0.109	0	1	0.006	0.076	0	1
1998	0.041	0.198	0	1	0.100	0.300	0	1
1999	0.194	0.395	0	1	0.159	0.365	0	1
2000	0.206	0.404	0	1	0.160	0.367	0	1
2001	0.156	0.363	0	1	0.173	0.379	0	1
2002	0.154	0.361	0	1	0.194	0.395	0	1

Number of observations: Assigned Risk = 250,381; Not Assigned Risk = 1,911,584

Table 4—Results of Logit Model of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Estimate	Std. Error	Pr > Chi Sq.	Marginal Effect
Intercept	-7.291556	0.038408	<.0001	
Company Characteristics/Risk Context:				
Effective Premium Rate-Company	4.794746	0.133973	<.0001	0.4129206
Geographic Concentration Ratio	1.250224	0.013333	<.0001	0.1076686
Policy Count	-0.000052	0.0000001	<.0001	-0.0000045
Cession Limit	0.760975	0.019534	<.0001	0.0655347
Policy Characteristics:				
Effective Premium Rate-Policy	4.64629	0.04406	<.0001	0.40014
Loss Ratio Index	0.08056	0.00098	<.0001	0.00694
County Loss Ratio	0.89478	0.00492	<.0001	0.07706
Number of Actual Yields	-0.02399	0.00097	<.0001	-0.00207
Yield Span	0.18860	0.01100	<.0001	0.01624
Coverage Level	0.04433	0.00040	<.0001	0.00382
Net Acres Insured	0.00011	0.00000	<.0001	0.00001
Years	-0.00786	0.00239	0.001	-0.00068
CAT Coverage	-0.70601	0.01488	<.0001	-0.06080
Insurance Plan:				
Crop Revenue Coverage (CRC)	0.32410	0.00550	<.0001	0.02791
Revenue Assurance (RA)	0.31334	0.00816	<.0001	0.02698
Income Protection (IP)	-0.49411	0.03655	<.0001	-0.04255
Crop:				
Soybeans	0.20004	0.00623	<.0001	0.01723
Wheat	0.59817	0.00635	<.0001	0.05151
Cotton	0.02156	0.02406	0.3702	0.00186
Year:				
1998	-0.94714	0.01524	<.0001	-0.08157
1999	0.44928	0.01052	<.0001	0.03869
2000	0.42714	0.00930	<.0001	0.03678
2001	-0.15081	0.00845	<.0001	-0.01299
2002	-0.27611	0.00784	<.0001	-0.02378

Model Fit: Percent Concordant = 79.7; Percent Discordant = 19.8; Percent Tied = 0.4.

Criterion	Only	Covariates
AIC	1550115.1	1277294.0
SC	1550127.7	1277608.7
-2 Log L	1550113.1	1277244.0

Table 5—Signs and Significance of Estimates of Firm-Level Logit Models of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Positive and Significant	Negative and Significant	Not Significant
Intercept	2	14	1
Company Characteristics/Risk Context:			
Effective Premium Rate-Company	11	4	2
Geographic Concentration Ratio	6	7	4
Policy Count	2	12	3
Cession Limit	10	3	4
Policy Characteristics:			
Effective Premium Rate-Policy	17	0	0
Loss Ratio Index	17	0	0
County Loss Ratio	16	0	1
Number of Actual Yields	1	15	1
Yield Span	10	6	1
Coverage Level	14	2	1
Net Acres Insured	14	2	1
Years	6	5	6
CAT Coverage	3	11	3
Insurance Plan:			
Crop Revenue Coverage (CRC)	10	5	2
Revenue Assurance (RA)	9	4	4
Income Protection (IP)	2	6	9
Crop:			
Soybeans	13	1	3
Wheat	14	2	1
Cotton	6	5	6
Year:			
1998	2	10	5
1999	5	7	5
2000	9	5	3
2001	8	7	2
2002	5	3	9

Table 6—Results of Tobit Model of Crop Insurance Policy Loss Ratios

Variable	Estimate	Std. Error	Pr > Chi Sq.	Marginal Effects
Intercept	-10.33	0.1082	<.0001	
Risk Context:				
Cession Limit	4.0937	0.0592	<.0001	1.037
Policy Characteristics:				
Effective Premium Rate-Policy	20.1367	0.153	<.0001	5.103
Loss Ratio Index	0.1456	0.0025	<.0001	0.037
County Loss Ratio	-0.4721	0.0183	<.0001	-0.120
Number of Actual Yields	-0.2041	0.0031	<.0001	-0.052
Yield Span	1.6069	0.0354	<.0001	0.316
Coverage Level	0.0170	0.0013	<.0001	0.004
Net Acres Insured	-2.7637	0.0354	<.0001	-0.700
Years	0.0016	0	<.0001	0.0004
CAT Coverage	0.2659	0.0102	<.0001	0.067
Insurance Plan:				
Crop Revenue Coverage (CRC)	0.7638	0.0172	<.0001	0.194
Revenue Assurance (RA)	0.0588	0.065	0.3655	0.015
Income Protection (IP)	-0.8773	0.0985	<.0001	-0.222
Crop:				
Soybeans	0.8130	0.0181	<.0001	0.206
Wheat	0.3771	0.0211	<.0001	0.096
Cotton	0.3653	0.0867	<.0001	0.093
Scale	4.935	0.0093		

Number of Observations = 910,735
Noncensored Values = 185,329
Right Censored Values = 0
Left Censored Values = 725,406
Interval Censored Values = 0
Log Likelihood = 787304.5318

Table 7—Underwriting Gains under Alternative Allocations to Reinsurance Funds, 2001 – 2003

Item	Allocation		
	Actual	County-based Model	Policy-level Model
	1,000 Dollars		
Gross (Pre-SRA):			
Assigned Risk Fund:			
Premium	570,159	550,250	821,614
Indemnities	691,051	633,236	990,809
Gain	(120,892)	(82,986)	(169,196)
Commercial Funds:			
Premium	2,531,534	2,551,443	2,280,080
Indemnities	2,197,224	2,255,039	1,897,466
Gain	334,310	296,404	382,614
Total Gain	213,418	213,418	213,418
Net (Post-SRA):			
Assigned Risk Fund:			
Retained Premium	114,032	110,050	164,323
Gain	667	1,161	820
Commercial Funds:			
Retained Premium	2,531,534	2,551,443	2,280,080
Gain	310,672	290,850	320,129
Total:			
Retained Premium	2,645,566	2,651,493	2,444,402
Gain	311,339	292,011	320,949
Gain as a Percent of Retained Premium	11.8	11.0	13.1

Table 8—Percent of Premium in Assigned Fund, Loss Ratio, and Underwriting Gains under Actual, County and Policy-level Model Allocations to the Reinsurance Funds, by Firm

Company	Percent of Gross Premium in Assigned Risk Fund			Gross Loss Ratio	Net (Post-SRA) Underwriting Gain		
	Allocation				Allocation		
	Actual	County	Policy		Actual	County	Policy
	Percent of Gross Premium				*Percent of Retained Premium*		
1	0.2	0.1	9.6	0.38	36.0	36.0	35.9
2	10.2	8.6	14.3	0.50	25.6	25.3	26.8
3	9.7	14.8	11.5	0.65	27.2	21.9	24.6
4	21.4	5.3	18.4	0.70	20.6	20.0	21.6
5	17.1	13.3	23.0	0.81	17.3	15.9	18.7
6	24.7	10.8	25.8	0.85	17.5	15.1	17.4
7	21.6	19.5	26.7	0.85	17.4	16.1	17.0
8	17.1	21.6	28.7	0.96	10.0	9.8	11.3
9	26.6	19.0	25.4	0.98	6.8	4.9	7.7
10	16.3	14.3	25.5	0.99	9.7	9.6	11.7
11	20.0	24.0	30.8	1.00	7.2	9.7	10.2
12	13.8	19.9	27.5	1.03	8.5	6.1	9.2
13	16.3	20.6	28.6	1.04	(0.5)	(0.7)	3.0
14	32.9	24.8	35.7	1.05	5.9	5.7	8.8
15	32.2	35.4	43.6	1.14	7.5	5.5	7.5
16	46.7	48.6	56.0	1.19	(8.8)	(2.8)	(2.0)
17	3.2	6.1	19.9	1.28	(8.9)	(8.5)	(6.2)

Appendix Table 1— Results of Firm-level Logistic Models of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Company								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Intercept	-193.90	**23.36**	**-11.51**	**-2.62**	**-13.88**	**-8.71**	**-15.33**	**1.09**	**-7.33**
Company Characteristics/Risk Context:									
Effective Premium Rate-Company	-70.96	**-35.16**	**73.12**	**2.89**	**21.68**	**6.02**	**-7.90**	**3.37**	**-6.81**
Geographic Concentration Ratio	100.70	**-196.40**	**0.51**	**-13.66**	**-9.79**	**6.01**	**61.75**	**-177.00**	-3.10
Policy Count	0.0028	**-0.0001**	**0.0000**	**-0.0001**	**-0.0001**	**0.0001**	**-0.0003**	**-0.0001**	**0.0002**
Cession Limit	214.30	**15.30**	**-27.89**	**3.23**	**0.08**	**2.52**	**-1.42**	**0.64**	**5.38**
Policy Characteristics:									
Effective Premium Rate-Policy	**15.28**	**9.68**	**12.78**	**6.20**	**6.58**	**11.41**	**11.32**	**4.34**	**1.53**
Loss Ratio Index	**0.06**	**0.04**	**0.02**	**0.04**	**0.11**	**0.12**	**0.02**	**0.03**	**0.02**
County Loss Ratio	0.07	**3.83**	**1.56**	**0.31**	**1.36**	**0.74**	**1.52**	**1.44**	**0.70**
Number of Actual Yields	**-0.07**	**-0.04**	**-0.04**	**-0.02**	**-0.03**	**-0.03**	**-0.03**	**-0.06**	**0.04**
Yield Span	0.45	**0.95**	**0.46**	**-0.28**	**0.46**	**0.36**	**1.67**	**0.46**	**-0.55**
Coverage Level	**0.26**	**0.10**	**0.07**	**0.03**	**0.12**	**0.05**	**-0.03**	**0.07**	**0.05**
Net Acres Insured	**0.0007**	-0.0001	**-0.0003**	**0.0004**	**0.0001**	**0.0001**	**0.0002**	**0.0001**	**0.0002**
Years	-0.09	0.01	0.00	0.00	0.01	**-0.07**	**-0.04**	**0.06**	0.00
CAT Coverage	**3.52**	-2.41	**-2.14**	**0.32**	**-0.97**	**-0.17**	**-0.86**	**-1.59**	**-0.14**
Crop Revenue Coverage (CRC)	-0.09	-0.14	**1.49**	**0.14**	**0.14**	**-0.06**	**0.86**	**-0.34**	**0.54**
Revenue Assurance (RA)	**-0.39**	-0.09	**1.14**	**-0.51**	0.05	**0.09**	**1.66**	**0.30**	**0.13**
Income Protection (IP)	0.07	-0.28	**0.00**	**0.50**	**-0.70**	**-0.26**	0.47	0.02	-7.17
Soybeans	0.46	**0.31**	**0.24**	0.01	0.02	**0.33**	**0.24**	**0.32**	**0.13**
Wheat	**-1.13**	**1.98**	**-3.06**	**0.72**	**0.58**	**0.40**	**2.36**	**0.51**	**0.77**
Cotton	--	**1.62**	-9.36	**-1.32**	**0.38**	**-0.94**	--	**-0.25**	**0.42**
Percent Concordant	98.5	93.4	92.4	76.3	90.8	80.4	91.9	84.9	80.6

Estimates in bold are significant at the 0.10 level.

---continued

Appendix Table 1— Results of Firm-level Logistic Models of Designation of Crop Insurance Policies to Assigned Risk Fund

Variable	Company								
	10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	
Intercept	**-4.29**	**-10.17**	**-91.37**	**-7.99**	**-5.72**	**-1.48**	**-10.69**	**-16.34**	
Company Characteristics/Risk Context:									
Effective Premium Rate-Company	**14.41**	**20.50**	**9.07**	**3.03**	1.00	**7.36**	**-8.44**	**940.70**	
Geographic Concentration Ratio	**-58.39**	**26.23**	**1497.60**	1.02	**-12.29**	**-18.03**	**10.80**	**--**	
Policy Count	**-0.0001**	**-0.0003**	**0.0000**	**-0.0001**	0.0000	-0.0001	**-0.0004**	**-0.0478**	
Cession Limit	**1.27**	**0.33**	**1.62**	-0.27	**-1.74**	**1.65**	**2.67**	**--**	
Policy Characteristics:									
Effective Premium Rate-Policy	**3.64**	**4.55**	**5.20**	**2.78**	**4.45**	**5.39**	**1.97**	**6.85**	
Loss Ratio Index	**0.16**	**0.01**	**0.19**	**0.03**	**0.12**	**0.36**	**0.26**	**0.12**	
County Loss Ratio	**1.27**	**1.51**	**0.86**	**0.94**	**1.33**	**0.46**	**0.57**	**1.13**	
Number of Actual Yields	**-0.03**	**-0.03**	**-0.03**	**-0.02**	**-0.05**	**-0.06**	0.00	**-0.10**	
Yield Span	-0.03	**0.70**	**-0.42**	**0.45**	**0.57**	**-0.35**	**-0.33**	**-1.70**	
Coverage Level	**0.05**	**0.01**	**0.06**	**0.04**	**0.05**	**0.03**	**0.04**	-0.01	
Net Acres Insured	**0.0001**	**0.0002**	**0.0003**	**-0.0002**	**0.0002**	**0.0004**	**0.0002**	**0.0019**	
Years	**-0.09**	**-0.03**	**-0.04**	**0.11**	**0.04**	**0.06**	**0.00**	**0.50**	
CAT Coverage	**-0.77**	**-2.57**	**-1.57**	**0.25**	**-0.51**	-0.02	-0.27	-12.84	
Crop Revenue Coverage (CRC)	**0.36**	**0.65**	**0.22**	**0.38**	**-0.21**	0.03	**-0.30**	**0.80**	
Revenue Assurance (RA)	**0.45**	**1.52**	**0.27**	**0.20**	**-0.41**	**-0.37**	0.01	**--**	
Income Protection (IP)	**-0.30**	**1.40**	**-0.70**	**-1.06**	-0.28	-8.15	-0.56	**--**	
Soybeans	**0.11**	**1.16**	**0.07**	**0.37**	**-0.29**	**0.16**	**0.54**	**0.76**	
Wheat	**0.12**	**0.99**	**0.11**	**0.74**	**0.49**	**0.29**	2.14	**1.34**	
Cotton	**-0.80**	**0.59**	-0.04	-10.03	-0.15	**-0.50**	-0.05	**--**	
Percent Concordant	85.5	88.8	86.2	75.2	80.1	83.0	86.4	84.2	

Estimates in bold are significant at the 0.10 level.